SYSTEM AND METHOD FOR ORDERING HAPTIC EFFECTS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit under 35 U.S.C. 119(e) of U.S. Provisional Application Ser. No. 60/587,904, entitled "System and Method for Ordering Haptic Effects," filed Jul. 15, 2004, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] The invention relates generally to haptic feedback devices. More specifically, the invention relates to systems and methods for ordering haptic effects.

[0003] Devices that provide tactile feedback, such as haptic feedback, have enjoyed increased popularity in recent years. These devices are used in a variety of different applications. For example, devices providing haptic feedback are popular in various computer gaming applications, where the haptic feedback enhances the overall gaming experience of a user. In addition to gaming applications, haptic feedback devices also have been used in a variety of other computer-application contexts. For example, haptic-enabled controllers, such as mouse devices, can be configured to provide haptic feedback to a user while the user interacts with an operating system (OS), or other application.

[0004] Similarly, tactile feedback has been incorporated in various virtual reality applications to enhance the overall experience of a user. For example, haptic feedback can be incorporated in a virtual environment to provide a more realistic interactive simulation experience. Surgery simulation, for example, is a virtual reality environment where haptic feedback has been used to provide a user with a more realistic experience and, hence, a more educational experience.

[0005] Tactile feedback has also been increasingly incorporated in portable electronic devices, such as cellular telephones, personal digital assistants (PDAs), portable gaming devices, and a variety of other portable electronic devices. For example, some portable gaming applications are capable of vibrating in a manner similar to control devices (e.g., joysticks, etc.) used with larger-scale gaming systems that are configured to provide haptic feedback. Additionally, devices such as cellular telephones and PDAs are capable of providing various alerts to users by way of vibrations. For example, a cellular telephone can alert a user to an incoming telephone call by vibrating. Similarly, a PDA can alert a user to a scheduled calendar item or provide a user with a reminder for a "to do" list item or calendar appointment.

[0006] Generally, vibrations output by standard portable electronic devices, such as PDAs and cellular telephones, are simple vibrations, which operate as binary vibrators that are either on or off. That is, the vibration capability of those devices is generally limited to a full-power vibration (a "fully on" state), or a rest state (a "fully off"). Thus, generally speaking, there is little variation in the magnitude of vibrations that can be provided by such devices.

[0007] Existing devices, however, are rather rudimentary and do not provide sophisticated tactile feedback. Accordingly, it would be desirable to provide more sophisticated vibrations, which can convey additional information (e.g., by way of a sophisticated series of effects), and which can provide a user with an enhanced tactile experience beyond what is possible using devices that are currently available.

SUMMARY

[0008] An embodiment of the invention provides an apparatus that includes an ordering component and an output component. The ordering component is configured to associate each basis haptic effect from multiple basis haptic effects with a time slot from multiple time slots. The output component is configured to associate each basis haptic effect from the multiple basis haptic effects with an effect slot from multiple effect slots. The output component is also configured to cause each basis haptic effect from the multiple basis haptic effects to be output during the time slot associated with that haptic effect.

[0009] Another embodiment of the invention provides a method that receives a signal associated with multiple haptic effects. Each haptic effect from the multiple haptic effects is associated with a time slot from multiple time slots. The method also associates each haptic effect from the multiple haptic effects with an effect slot from multiple effect slots at least partially based on the time slot associated with that haptic effect. The method also sends an output signal for each effect slot from the multiple effect slots, when the associated haptic effect is scheduled for its time slot. The method can be implemented by a processor device, such as a computer, using a processor-readable medium comprising computer code representing instruction configured to cause a processor to implement the method.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] **FIG. 1** is a block diagram of a processor system, according to an embodiment of the invention.

[0011] **FIG. 2** is a block diagram of a system configured to order haptic effects, according to an embodiment of the invention.

[0012] **FIG. 3** is a block diagram of a system configured to order haptic effects, according to another embodiment of the invention.

[0013] **FIG. 4** is a block diagram of a system configured to order haptic effects, according to another embodiment of the invention.

[0014] **FIG. 5** is a block diagram of an output component, according to an embodiment of the invention.

[0015] **FIG. 6** is a block diagram of a file structure, according to an embodiment of the invention.

[0016] **FIG. 7** is a block diagram of a timeline-effect file structure, according to an embodiment of the invention.

[0017] **FIG. 8** is a block diagram of an effect-storage-block file structure, according to an embodiment of the invention.

[0018] **FIG. 9** is a block diagram of an effect-name block file structure, according to an embodiment of the invention.

[0019] **FIG. 10** is a block diagram of a timeline-effect definition, according to an embodiment of the invention.